22p.

THIRD SEMI-ANNUAL REPORT

TO

THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

UNDER RESEARCH GRANT NO. NsG-338

BY

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ORONO, MAINE

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ABSTRACT

Last fall the University of Maine proposed and received approval of an extension to its Institutional Research Grant No. NsG-338 (original date, October 1962). The research and scholarly activity performed under this grant and its extension during the past half year are summarized in this third semi-annual report.

The extent of faculty research has substantially increased. Graduate student participation in space related research in several areas of the University has been strengthened by availability of research assistantships under the Research Grant.

INTRODUCTION

The National Aeronautics and Space Administration has a variety of programs through which it seeks to strengthen the research capability of the nation's universities. One program involves "seed grants" to institutions with growing potential. Such a grant was made to the University of Maine in 1962.

Because of the interest and activity generated in space-related research at the University by the original award, NsG-338, an extension involving substantially increased funds was approved in the fall of 1963.

SPACE RESEARCH COMMITTEE

Both the initial grant and the extension are the responsibility of the Space Research Committee which consists of faculty and administrators broadly representative of the entire University. The group has prepared the proposals to NASA and administered the funds made available from it.

Since its original formation a number of administrators have been added to the committee. To give better balance, two additional faculty, one from Biochemistry, and one from Mathematics, are being added. The Committee solicits applications from the faculty for funds to begin studies or research related to space science and technology. After the proposals have been ranked on a merit basis, awards are made to the limit of available funds.

The Space Research Committee continues to be guided by two broad objectives:

1. To increase research at the University related to space science and technology, and
2. To improve Maine's graduate programs through research participation of students.

Composition of Space Research Committee

The Committee now consists of:

Dr. Ralph E. Armington

Dean Thomas H. Curry, Chairman

Dr. George F. Dow

Dean Franklin P. Eggert

Prof. Richard C. Hill

Dr. H. Austin Peck

Dr. Bruce R. Poulton

Dr. George A. Prescott

Dr. Frederick H. Radke

Dr. Arnold H. Raphaelson

Dr. Benjamin R. Speicher

Faculty member from Mathematics -

to be appointed September, 1964

Awards Made under the Extension to Grant NsG-338

In the first year about $25,000 was made available to the University for direct expenditure by the Space Research Committee. Details of the investigations which it approved have been described in previous semi-annual reports.

Under the provisions of the extension of NsG-338, which became effective October, 1963, the Committee has about $60,000 for support of research during the period October 1963 to September 30, 1964. Under the step-funding procedure of NASA, the Committee is also assured of $40,000 for the following year, ending September 30, 1965. By the time approval of the extension had been announced by NASA and proposals had been solicited, submitted, and awards made, the Spring semester was at hand. After considerable discussion the Committee decided that the period ending June 30, 1965, was a logical one to use as a basis for its actions. Some of the projects begin as of February 1, then, while others are not being initiated until this summer.

The amount awarded to date this year by the Space Research Committee is about $70,000. Although this is considerably more than the approximately $60,000 available to it before October, 1964, the Committee feels its action is justified because much of the approved expenditures will be made next academic year.

Changes in Operating Policy of the Space Research Committee

The only major change in operating policy since the last semi-annual report follows from the increased amount of money available to the Committee. Money was allocated for nine research assistantships for graduate students in connection with projects approved this Spring. This is in sharp contrast to

student support available in the first year. This development is also in keeping with the second of the major objectives approved by NASA - that is, "to strengthen programs of graduate study at the University by participation of graduate students in space-related research".

Awards by Space Research Committee - January, 1964

Title	Investigator(s)	Amount	Area
The Application of Modern Communication Theory Techniques to the Analysis of Electrocardiographic Functions.	Dr. E. M. Sheppard Mr. A. I. Whitney	$8,452	Electrical Engineering
The Impact of a Space Facility on a Small Community. A Case Study of Andover, Maine.	Prof. S. Hyatt Dr. J. Delphendahl Mr. F. Montville	1,000	Agricultural Business and Economics
Effect of Increasing the CO_2 Tension of Inspired Air on Nutrient Intake and Digestibility.	Dr. W. H. Hoover Dr. B. R. Poulton	4,200	Animal Science
An Investigation of the Point Defects of CaF_2 and BaF_2 Due to Rare Earth Ions.	Dr. D. W. Wylie	5,750	Physics
The Interrelations of Type of Atmosphere, Carbon Dioxide Concentration and Chemical Stimulation of the Photosynthetic Response in Green Plants.	Dr. G. R. Cooper Dr. M. T. Hilborn	3,500	Botany and Plant Pathology
Variations in Biochemical Properties of a Photosynthetic Protist as a Function of Environmental Conditions, in Chemostat Cultures.	Dr. J. R. Cook	8,580	Zoology
Design and Study of a New Apparatus for the Determination of Second Virial Coefficients of Organic Vapors.	Dr. R. D. Dunlap	7,427	Chemistry
Non-Linear Characteristics of the Interaction of Microwaves with an Electrodeless Discharge.	Dr. G. S. Harmon	5,710	Physics
Discontinuous Rate Compensation for Servo Systems.	Prof. W. W. Turner	7,075	Electrical Engineering

Awards by Space Research Committee - January, 1964 (continued)

Title	Investigator(s)	Amount	Area
The Function of Abnormally Fragile Tissue Membranes in Fatigue-Induced Stress.	Dr. J. A. Smith Dr. F. H. Radke	$5,760	Biochemistry
A Force-Momentum Demonstration Apparatus	Prof. R. C. Hill Dr. G. T. Davis	1,250	Mechanical Engineering and Education
Study of Interface Phenomena in Filament Wound Glass Reinforced Plastic Composites.	Prof. C. A. Bouc	3,457	Engineering Graphics
A Study of Digestibility of Plant Tissue in Animals and the Effect of Stress on the Metabolism of Plant Tissue Culture.	Dr. A. R. Whitehill Dr. F. H. Bird	4,500	Bacteriology
Mechanism of Acid-Catalyzed Alkylation of Aromatic Hydrocarbons.	Dr. J. W. Wolfhagen	3,085	Chemistry

BUDGET

Comparison of Awards with Predicted Distribution

In its application to the National Aeronautics and Space Administration for an extension of Institutional Research Grant NsG-338, the Space Research Committee predicted a distribution of funds as follows:

Item	Predicted	Awarded
Salary	42%	26%
Supplies	10	7
Equipment	15	19
Student Assistance	28	43
Travel	2.5	2
Miscellaneous	2.5	3

The actual distribution based on proposals approved by the Committee under the extension to NsG-338 is shown as the third column above.

The major differences between the distribution predicted in the applica-

tion to NASA and that involved in the awards are in the Salary and Student Service categories. This discrepancy results from the Committee's decision to strengthen graduate programs by awarding more research assistantships than was originally planned. In fact, the sum of salary and student assistance items was predicted to be 70%. For the actual rewards the sum is 69%.

From the funds available under the extension to Grant No. NsG-338, nine research assistantships were provided for graduate students in connection with applications approved by the Space Research Committee.

Continuation of Existing Projects

In its request to NASA for extension of Grant No. NsG-338, the Space Research Committee predicted that it would receive proposals for continued support of projects approved under the original grant. This indeed was the case. The six investigations listed below are extensions of six among the original ten funded.

Title	Investigator(s)	Amount	Department
The Application of Modern Communication Theory Techniques to the Analysis of Electrocardiographic Functions.	Dr. E. M. Sheppard Mr. A. I. Whitney	$8,542	Electrical Engineering
The Impact of a Space Facility on A Small Community. A Case Study of Andover, Maine.	Prof. S. Hyatt Dr. J. Delphendahl Mr. F. Montville	1,000	Agricultural Business and Economics
Effect of Increasing the CO_2 Tension of Inspired Air on Nutrient Intake and Digestibility.	Dr. W. H. Hoover Dr. B. R. Poulton	4,200	Animal Science
An Investigation of the Point Defects of CaF_2 and BaF_2 Due to Rare Earth Ions.	Dr. D. W. Wylie	5,750	Physics
The Interrelations of Type of Atmosphere, Carbon Dioxide Concentration and Chemical Stimulation of the Photosynthetic Response in Green Plants.	Dr. G. R. Cooper Dr. M. T. Hilborn	3,550	Botany and Plant Pathology

Title	Investigator(s)	Amount	Department
The Function of Abnormally Fragile Tissue Membranes in Fatigue-Induced Stress.	Dr. J. A. Smith Dr. F. H. Radke	$5,760	Biochemistry

Projects Not Requiring Further Support from the Space Research Committee

Fluid Control Devices.	Dr. R. A. Comparin		Mechanical Engineering
Structures and Behavior of Firms in the Rubber Industry.	Dr. J. D. Coupe		Business and Economics
Effect of Small Amounts of Chemical Additives on the Rate of Mass Transfer from Gas to Liquid.	Dr. S. A. Zieminski		Chemical Engineering
Preliminary Study of Sounds About and Within the Human Body.	Prof. W. M. Libbey		Electrical Engineering

New Awards

Proposals funded by the Space Research Committee under the Grant Extension are:

Variations in Biochemical Properties of a Photosynthetic Protist as a Function of Environmental Conditions, in Chemostat Cultures.	Dr. J. R. Cook	$8,580	Zoology
Design and Study of a New Apparatus for the Determination of Second Virial Coefficients of Organic Vapors.	Dr. R. D. Dunlap	7,427	Chemistry
Non-Linear Characteristics of the Interaction of Microwaves with an Electrodeless Discharge.	Dr. G. S. Harmon	5,710	Physics
Discontinuous Rate Compensation for Servo Systems.	Prof. W. W. Turner	7,075	Electrical Engineering
A Force-Momentum Demonstration Apparatus.	Prof. R. C. Hill Dr. G. T. Davis	1,250	Mechanical Engineering and Education
Study of Interface Phenomena in Filament Wound Glass Reinforced Plastic Composites.	Prof. C. A. Bouc	3,457	Engineering Graphics

New Awards (continued)

Title	Investigator(s)	Amount	Department
A Study of Digestibility of Plant Tissue in Animals and the Effect of Stress on the Metabolism of Plant Tissue Culture.	Dr. A. R. Whitehill Dr. F. H. Bird	$4,500	Bacteriology
Mechanism of Acid-Catalyzed Alkylation of Aromatic Hydrocarbons.	Dr. J. W. Wolfhagen	3,085	Chemistry

Some of the above were submitted but not supported under the original grant because of a lack of funds.

Details of Projects

Details about the projects continued, those not requiring further support and the ones funded for the first time are given in Appendix I, II and III respectively.

Respectfully submitted,

T. H. Curry
for the
Space Research Committee

APPENDIX I

PROJECTS CONTINUED

"The Application of Modern Communication Theory Techniques to the Analysis of Electrocardiographic Functions" - Dr. Edmund M. Sheppard and Mr. Allison I. Whitney

Proposal

To date, most electrocardiographic studies have been based solely on time domain analysis. It is felt that the application of probability density functions, moments, Fourier analysis, auto- and cross-correlation funcations, and power spectral density concepts would be quite usefuly in analyzing electrocardiograph functions.

Results

This work is being continued by Dr. Sheppard as "The Study of Cardiographic Functions".

As a result of the previous study two areas are being investigated further. The first is the apex cardiogram, a record of pressure vs. time near the apex of the heart. Frequently difficult to obtain, these functions have been accentuated by the use of averaging techniques. Autocorrelation and spectral density computations have been made and now appear promising.

The second area of investigation is variation of the dielectric and conductive properties of the thorax due to cardiac activity. A definite relationship has been established and it is felt information relative to blood flow may be obtained.

It is believed that this investigation is pertinent to the space program since monitoring the physical condition of man is essential to space flight.

APPENDIX I

PROJECTS CONTINUED (continued)

"Effect of Stress Induced by Fatigue and Monotony on the Formation of Tissue Lipid from Dietary Protein" - Dr. Frederick H. Radke and Dr. Herman DeHaas

Proposal

The conversion of dietary protein to tissue fat will be used to compare the metabolism of rats which will be stressed (by being rotated in a smooth motor-driven black drum up to the limit of the rat's endurance) with that of rats living under better conditions in cages. Radioactive rat tissue protein will be fed to the rats at an adequate dietary level and the formation of radioactive tissue lipid, protein and CO_2 will be measured.

Results

Dr. Radke and Dr. J. A. Smith are continuing work resulting from the earlier investigation. The new project deals with "The Function of Abnormally Fragile Tissue Membranes in Fatigue-Induced Stress" - the tissue fragility to be brought about by a deficiency of polyunsaturated fatty acids.

A dietary lack of certain polyunsaturated fatty acids such as linoleic acid results in defective cellular and subcellular membranes, especially in tissues having a relatively rapid turnover rate such as liver, skin and red blood cells. Without stress these abnormal membranes appear to function well enough to allow life but not growth in rats. To determine the effect of stress on the abnormal membrane function, rats will be maintained on a fat-deficient diet until classical symptoms of a polyunsaturated fatty acid deficiency become evident. Then the rats will be subjected to stress by being rotated in a smooth motor-driven black drum up to the limit of their endurance. Animals subjected to the same stress but fed a complete diet will be used for comparison.

The formation of tissue lipids and carbon dioxide from radioactive acetate will be measured as well as the metabolic rate of liver preparations.

The research is related to space travel because of the possibility that an inadequate supply of polyunsaturated acids resulting from either a poorly composed diet or defective packaging (which would allow oxidative rancidity) would have a deleterious effect on an individual undergoing prolonged space travel.

Any abnormality resulting from inadequate nutrition will be aggravated by the application of stress since under these conditions metabolic requirements are increased. Polyunsaturated fatty acids are intimately involved in the structural phospholipids of the subcellular particles considered to be responsible for cellular respiration and energy exchange.

"The Impact of a Space Facility on a Small Community. A Case Study of Andover, Maine" - Asst. Prof. Stephen Hyatt, Dr. Johannes Delphendahl, Mr. Francis Montville

Proposal

It is assumed that the introduction of a space facility will bring about certain social and economic changes in the local community. This study will seek to determine what these changes are and how local communities might plan more effectively in future instances when a space facility is introduced. The Andover area is relatively small in size, can be investigated in a comparatively short period of time, and hence is a desirable community to study.

Results

The previous investigation involved primarily data collection from a variety of sources, such as interviews with community residents and Telstar employees as well as town and county records.

APPENDIX I

PROJECTS CONTINUED (continued)

A preliminary analysis of part of the accumulated data has raised certain questions which are to be investigated further. For example, even though the Telstar Station at Andover expends considerable money each month, the local community's absorption capacity is limited. Local business firms are unable to supply the services needed by the Station, so these services are obtained elsewhere. The question then follows - what is the economic community of Telstar and what implications has this for the local community of Andover?

"An Investigation of the Point Defects in Calcium Fluoride and Barium Fluoride Crystals Due to Rare Earth Ions" - Dr. Douglas W. Wylie

Proposal

These substances are being considered as Laser crystals. Investigation of point defects may yield significant information concerning their optical properties. The effects of x-ray and ultraviolet irradiations on CaF_2 and BaF_2 crystals will be examined using electron spin resonance technique.

Results

Dr. Wylie is continuing his research as "An Investigation of Effects of Radiation on BaF_2 and SrF_2 Doped with Ga^{+++} Ions".

Barium fluoride and strontium fluoride crystals doped with gadolinium will be examined in the electron spin resonance spectrometer constructed last year. Then the crystals will be irradiated with x-ray or ultraviolet light and examined again.

The ESR technique is especially sensitive to changes in the ionization state of an atom because it depends on unpaired electrons. If Ga^{+++} changes to Ga^{++} the change should be detectable. Also if other effects such as color centers develop, these should also be detectable.

PROJECTS CONTINUED (continued)

Information in the literature indicates an inconsistency in the results of imbedding rare earth ions in the fluoride crystals. This inconsistency arises because of the charge compensation necessary when Ga^{+++} substitutes for Ba^{++} in the crystals. It is generally agreed that the principal mode for compensation is a F^- ion in an adjacent interstitial site. However, this should cause an ESR spectrum of tetragonal symmetry. A large number of spectra are observed with cubic symmetry. An explanation for this has been that the fluoride ions pull in uniformly essentially producing a cubic spectrum.

This work would have a dual purpose; firstly, to attempt to shed some light on the charge compensation controversy, and secondly, since these crystals have Laser properties, any information on the effects of radiation on the crystals would be of interest.

"Effect of Increasing the CO_2 Tension of Inspired Air on Nutrient Intake and Digestibility" - Dr. William H. Hoover and Dr. Bruce R. Poulton

Proposal

Research with changes in carbon dioxide levels has shown it to elicit psychological responses such as excitation and depression and to have physiological activity in such areas as respiration rate, circulation rate, acid-base balance and unconsciousness. There is a dearth of information on the possible effects of increased level of CO_2 on the intake and utilization of nutrients.

Results

Since the initiation of the project in 1963, considerable time and effort have been spent in preparing the facilities. These were completed and data collection using sheep as experimental animal was started in late 1963.

The initial investigations completed to date include: feed intake and

PROJECTS CONTINUED (continued)

digestibility studies at levels of 4% and 8% CO_2. Beyond this, the studies will be continued into the range of 8 - 16% CO_2 and possibly higher depending on livability of the test animals. It is planned to investigate the physiological effects of increased CO_2 levels by autopsy on the animals which fail to survive the experiments.

"The Interrelations of Type of Atmosphere, Carbon Dioxide Concentration and Chemical Stimulation of the Photosynthetic Response in Green Plants" - Dr. George R. Cooper and Dr. Merle T. Hilborn

Proposal

Culture of Lemna minor L. will be subjected to various chemical compounds and the effects on the rate of photosynthesis noted. Any increase possible in rate of CO_2 assimilation would be of value in connection with life support systems.

Results

The status of this study for which Dr. Cooper and Dr. Hilborn have been granted additional funds by the Space Research Committee, is as follows:

1. An illuminated Warburg apparatus has been obtained from other research funds available at the University.
2. Methods have been tested and a satisfactory means of measuring photosynthesis and respiration of Lemna minor has been found.
3. Preliminary standardization of the photosynthetic potential of the test done of Lemna minor is well underway.

It is planned to evaluate certain organic compounds which may cause higher rates of photosynthesis. Also the effects of exotic atmospheres on the photosynthetic process, alone and in conjunction with the organic compounds, will be tested. Finally an attempt will be made to determine the phase of the "photosynthetic reaction" affected by both organics and gases.

APPENDIX II

PROJECTS DISCONTINUED

"Fluid Control Devices" - Dr. Robert A. Comparin

Proposal

The fluid mechanics problems directly related to fluid control devices with no moving parts will be studied. There is much current interest in engineering in the use of fluid elements to perform logic and control functions. These devices are particularly suitable for use in hot gas propulsion systems.

Results

The progress made by Dr. Comparin in his study of fluid control devices resulted in a proposal for further support to National Science Foundation.

The research proposal, "Jet Reattachment at Low Reynolds Number", dealt with the problem of jet reattachment to a solid boundary wall. It was proposed to study the reattachment of an incompressible jet to an inclined flat plate. The specific interest was in the reattachment at low Reynolds numbers where the reattachment point is a function of the Reynolds number.

Dr. Comparin has accepted employment at another academic institution and the work will not be continued at Maine.

"Structure and Behavior of Firms in the Rubber Industry" - Dr. John A Coupe

Proposal

Particular attention will be paid to the structure of the industry considering such topics as: numbers of firms and the degree of concentration; ability to enter the industry; product lines and product differentiation; market structure and conduct; and public policy. This is a pilot study with the objective of initiating the development of methods applicable to other firms or industries in the space program.

APPENDIX II

PROJECTS DISCONTINUED (continued)

Results

After a promising beginning Dr. Coupe advised the Space Research Committee of at least temporary inactivation of his project. He has not been able to obtain from industry the data essential to the study.

"Effect of Small Amounts of Chemical Additives on the Rate of Mass Transfer from Gas to Liquid" - Dr. Stefan A. Zieminski

Proposal

The effects of some organic and inorganic substances on the degree of dispersion of gas in liquid and their effects on the mass transfer coefficient will be investigated. The primary objective of the work is to increase the rate of absorption of a gas in a liquid phase.

Results

The investigator made considerable progress. It was shown that the addition of small quantities of organic substances increased the rate of mass transfer in air-water systems by increasing the interfacial area.

Dr. Zieminski was recently awarded a three-year research grant by the U. S. Public Health Service on the "Use of Chemical Additives to Improve Aeration Rates."

Aeration is an important step in the treatment of sewage by bio-oxidation and in many fermentation processes. It also has been used as a means of supplying oxygen to streams polluted by oxidizable matter.

In Dr. Zieminski's research under support by the Space Research Committee he had determined that the presence of small amounts of certain organic materials as solutes inhibits bubble coalescence, thereby increasing the interfacial area

APPENDIX II

PROJECTS DISCONTINUED (continued)

between air and the liquid phase. The increased interfacial area thus obtained increases the efficiency of oxygen absorption in bubble aeration.

It is understood also that the solute may have a catalytic effect on the mechanics of oxygen transfer.

Dr. Zieminski's award from the Public Health Service then is the direct result of his NASA support.

"A Preliminary Study of Sounds About and Within The Human Body" - Professor Waldo Libbey

Proposal

Involves frequency analysis of body sounds such as respiration and circulation for diagnostic purposes. Clincal staff of the Eastern Maine General Hospital are available for guidance. A variety of patients and ailments will be tested by Professor Libbey, using extensive analytical equipment of the Electrical Engineering Department.

Results

Because of the press of other duties and because of the initiation of work toward his PhD at another institution, Professor Libbey has not continued his investigations beyond the point reported in the first annual report to NASA (December, 1963).

It is anticipated that Professor Libbey will resume this activity in due course.

APPENDIX III

NEW PROJECTS

"Variations in Biochemical Properties of a Photosynthetic Protist as a Function of Environmental Conditions, in Chemostat Cultures" - Dr. James R. Cook

Proposal

This research deals with cell physiology. It is desired to relate long term growth and synthetic capacity of photosynthetic cells with their energy supply. Biochemical and physiological properties of Euglena gracilis will be determined in chemostat cultures after a sufficient number of generations have elapsed to allow stabilization of these properties. An initial objective of the study is to determine the energy level most effectively utilized by Euglena. Properties to be followed include total cell mass, protein, carbohydrate, nucleic acids, photosynthetic pigments, and respiratory and synthetic rates.

A longer range objective is to study the nature of the physiological change of Euglena in relation to abrupt change in energy level, that is, whether the change is straightforward or whether a transient metabolic behavior is elicited.

The research has direct applicability to space biology because of the possibility that the research may suggest a simple way of varying in known direction the ratios of important cellular constituents - lipids, carbohydrates and proteins.

"Design and Study of a New Apparatus for the Determination of Second Virial Coefficients of Organic Vapors" - Dr. Robert D. Dunlap

Proposal

Dr. Dunlap plans to construct an apparatus for determination of second virial coefficients of organic vapors and mixtures.

APPENDIX III

NEW PROJECTS (continued)

Second virial coefficients are important in study of intermolecular potential between molecules which is basic to understanding macroscopic properties of matter in the pure state and in mixtures. The proposed measurements will provide important design data for engineers.

"Non-linear Characteristics of the Interaction of Microwaves with an Electrodeless Discharge" - Dr. Gerald S. Harmon

Proposal

It is the purpose of this work to conduct an experimental investigation of the interaction of microwaves with an electrodeless gaseous discharge, with the particular object of obtaining a microwave amplification. There is some evidence that an electrodeless discharge, unlike other varieties, may be controlled adequately to be useful in confirmation of several aspects of plasma theory.

The research is pertinent to satellite communication and to properties of the ionosphere.

"Discontinuous Rate Compensation for Servo Systems" - Professor Walter W. Turner

Proposal

The project involves analysis of the effect of discontinuous change in the amount of rate feedback on the performance of a techometer stabilized servo system as the error magnitude, or the output velocity, approaches zero. It is thought that this type of a compensation scheme might lead to a different method of "optimalizing" a control system in the sense of using minimum fuel (or energy or time) to reach a specified terminal condition.

APPENDIX III

NEW PROJECTS (continued)

"A Force-Momentum Demonstration Apparatus" - Professors Richard C. Hill and George T. Davis

Proposal

Professor Hill, of the Mechanical Engineering Department, and Dr. Davis, mathematics and science specialist in the College of Education, propose to develop an inexpensive apparatus (complete with manual) which can be used by high school physics classes to study the variables associated with forces generated by fluid momentum change - as in rockets, aircraft, etc. By having students consider problems arising from changes in momentum where both solids as well as fluids are involved, the students can be better informed about the control of vehicles in space.

Present treatment of momentum - force relations associated with gas flow is inadequate in existing high school physics texts.

"Study of Interface Phenomena in Filament Wound Glass Reinforced Plastic Composites" - Assistant Professor Charles A. Bouc

Proposal

Glass filaments reinforced with a variety of resins are used as structural material in space, and other, technology. The tensile strength of the composites is much less than that of virgin glass filaments because of damage from partially unknown factors during manufacture. It is hoped that the research will contribute to increased strength of glass filament - resin composites.

It is proposed to study under load by microscopy the interaction at the glass - resin interface with the intent of determining the extent and mechanism, by which the resin reinforces the filament. As a result of his previous research the investigator believes that in current filament wound structures the brittleness of the resin and the close packing of the filaments precludes the possibility of the strained filament maintaining its bond with the surrounding resin.

APPENDIX III

NEW PROJECTS (continued)

"A Study of Digestibility of Plant Tissue in Animals and the Effect of Stress on the Metabolism of Plant Tissue Culture" - Dr. Alvin R. Whitehill and Dr. Francis H. Bird

Proposal

Isotopically marked protein or carbohydrate from plant tissue grown in medium containing radioactive carbon will be used:

1) To study possible adjuvants to increase the digestibility of food.

2) To study possible adjuvants to increase the absorption from the gastrointestinal tract.

A study of the basic metabolism of plant tissue grown under stress conditions will be made.

1) Lowered Oxygen tension

2) High irradiation

3) Varying magnetic fields

4) Other physical conditions present in space or in space vehicles

"Mechanism of Acid-Catalyzed Alkylation of Aromatic Hydrocarbons" - Dr. James L. Wolfhagen

Proposal

The investigator hopes to achieve a better understanding of the mechanisms involved in alkylation. This subject continues to be of importance in petroleum technology and hence to the nation's space program.

Gas chromatography and infrared spectrophotometry will be used in kinetic experiments with optically active alcohols and toluene in the presence of acid.